

► Colorado 2004–2005 School Immunization Survey



Colorado Department
of Public Health
and Environment

IMMUNIZATION PROGRAM

Colorado 2004–2005 School Immunization Survey

Colorado Board of Health rules pertaining to the immunization of students attending school require that a child entering kindergarten have 5 diphtheria/tetanus/pertussis (DTaP) shots, 4 polio shots, 2 measles/mumps/rubella shots (MMR), 3 hepatitis B shots and 1 varicella shot or history of having had varicella. A Certificate of Immunization in the school file is also required.

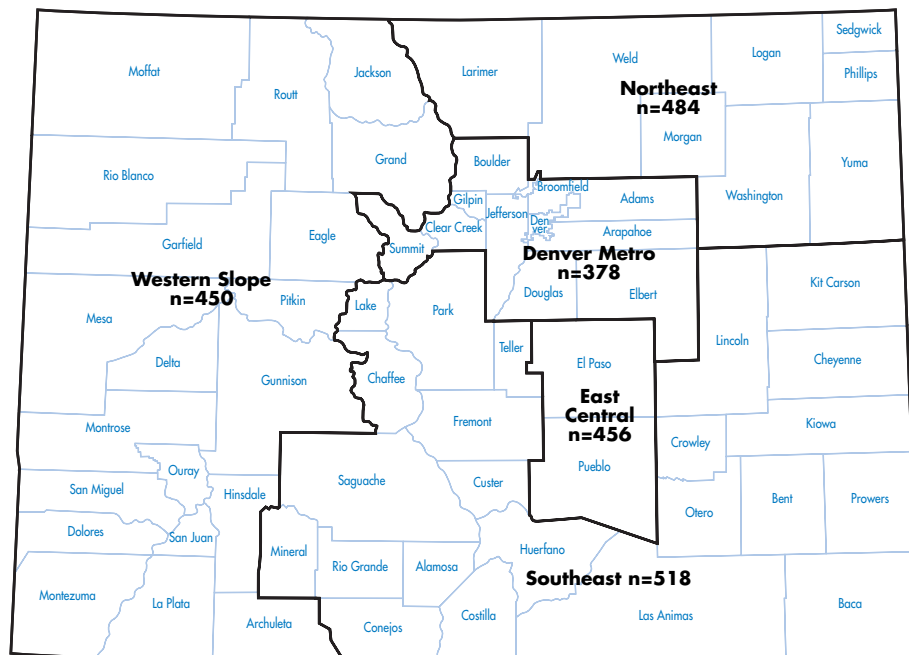
To ensure compliance with this rule, schools are required to submit an Immunization Summary Report to the Colorado Department of Public Health and Environment. For the past several years, immunization data has been self reported by schools. During the 2004–2005 school year, a new method of collecting immunization data at school entry was implemented by the Immunization Program at the Department of Public Health and Environment.

► Methods

Under this new system, the state was divided into five regions and a random sample of schools was selected from each region. The sample size per region was calculated based on coverage estimates from a 1992–1993 school survey where school records were audited from a sample of schools. The higher the coverage rate the smaller the sample needed to be. The sample size was not dependent on the number of

schools in a region but on the average number of children per school and the previous coverage level. Thus, regions with a higher average number of children per school and higher coverage levels would need to sample fewer schools to achieve the same level of precision ($\pm 5\%$). A map showing the counties assigned to each region and the number of students sampled in each region is shown below.

School and Childcare Survey Regions Sampled



A random sample of 20 children entering Kindergarten was drawn at each school. Local or state health department staff audited each child's immunization record. Information collected for children included age; gender; race; ethnicity; immunization document source, such as original document, photocopy or multiple documents; type of immunization document such as Certificate of Immunization, military record or other similar documents (See Table 2); vaccines administered with administration date; exemptions for medical, personal or religious reasons; immunization staff and the time they are on site; and the country of birth. These data were analyzed to calculate the immunization coverage of students entering kindergarten by region and statewide. State estimates were calculated by weighting the regional results. This ensured that each region was represented proportionally in the state estimates. Data were also analyzed to see if there were any factors statistically significantly associated with a child being up to date at school entry (Table 6).

Exemption information was collected for each of the required immunizations. Exemptions from vaccines were categorized in the following manner;

- Medical—medical exemptions for all vaccines
- Religious—religious exemptions for all vaccines
- Personal—personal exemptions for all vaccines
- In process—in the process of obtaining all the required vaccines
- Mixed exemptions—combination of medical, religious, or personal exemption or in process for all vaccines
- None—no exemptions taken for all vaccines
- Unknown—exemptions field was left blank for all vaccines
- Mixed other—combination of none or unknown for all vaccines
- No records—no records were in the school file

This report will discuss the results from the immunization coverage analysis and the compliance of schools in keeping the required immunization documents. In addition, this report will look at immunization exemptions and what shots were missing for students who were not up to date. The factors associated with being up to date at school entry will be presented along with conclusions.

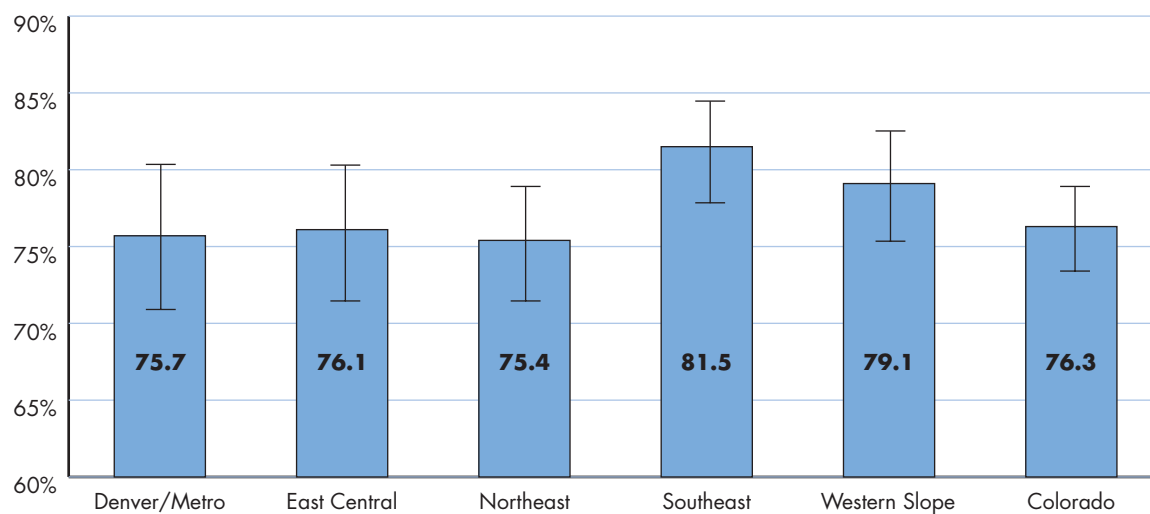


► Immunization Coverage

At entry into kindergarten, 76.3 % of children were up to date for

- 5 DTaP or 4 with the 4th on or after the 4th birthday
- 2 MMR
- 4 Polio or 3 with the 3rd on or after the 4th birthday
- 3 Hepatitis B
- 1 Varicella or a history of disease

Figure 1. Percentage of Children Up to Date at Kindergarten School Entry, by Region, School Survey 2004–2005



Error bars on the graph represent the 95 percent confidence interval for each point estimate. The upper and lower limit of the confidence interval represents the margin of error or the range of values where the true rate lies 95% of the time. Confidence intervals are used for data that are a sample of the population.

There was no statistical difference among the regions or compared to the state in the rate of children who were up to date at school entry.

Table 1. By Vaccine and Region, Up to Date Status, School Survey, 2004–2005

	5 DtaP or 4 with 4 th on or after the 4 th Birthday	2 MMR	4 Polio or 3 with 4 th dose on or after 4 th Birthday	3 Hep B	1 Varicella or History of Disease	Combination of all
Weighted Colorado Estimate						
Up to Date at School Entry	86.1%	85.1%	87.7%	91.2%	92.2%	76.3%
Not Up to Date at School Entry	13.9%	14.9%	12.3%	8.8%	7.8%	23.7%
Denver/Metro						
Up to Date at School Entry	84.1%	85.2%	86.8%	91.0%	92.1%	75.7%
Not Up to Date at School Entry	15.9%	14.8%	13.2%	9.0%	7.9%	24.3%
East Central						
Up to Date at School Entry	88.4%	83.8%	88.6%	91.5%	94.5%	76.1%
Not Up to Date at School Entry	11.6%	16.2%	11.4%	8.5%	5.5%	23.9%
Northeast						
Up to Date at School Entry	90.1%	85.1%	89.5%	89.9%	90.1%	75.4%
Not Up to Date at School Entry	9.9%	14.9%	10.5%	10.1%	9.9%	24.6%
Southeast						
Up to Date at School Entry	91.7%	88.6%	92.3%	94.4%	93.4%	81.5%
Not Up to Date at School Entry	8.3%	11.4%	7.7%	5.6%	6.6%	18.5%
Western Slope						
Up to Date at School Entry	87.1%	85.3%	87.6%	92.2%	91.3%	79.1%
Not Up to Date at School Entry	12.9%	14.7%	12.4%	7.8%	8.7%	20.9%

Similar to the National Immunization Survey results, Table 1 shows that while individual vaccine coverage levels were above 80%, the series coverage rate (4 DTaP, 3 Polio, 1 MMR, 3 Hib and 3 Hepatitis B) was less. Since history of varicella disease is not routinely recorded on immunization records, varicella coverage levels may be even higher.



► Immunization Documents

At entry into kindergarten an estimated 56.4 percent of children had approved certificates of immunization in their school records. Table 2 lists the percentages of the variety of records available in the child's school file that contained immunization information. Although a Certificate of Immunization is required according to Colorado School Immunization Law the percentage of children with a Certificate of Immunization on file varied from a low of 35.5 percent to 75.1 percent.

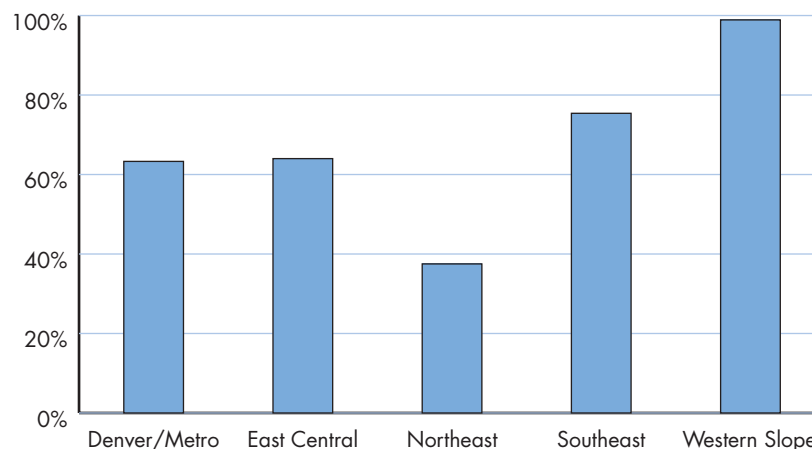
For children who were up to date, those with a Certificate of Immunization ranged from 64 percent to almost 100 percent (Figure 2). When the Certificate of Immunization was not

available immunization status was calculated using shot data available from the other types of school records listed in Table 2.

Table 2. Percentage of Immunization Documents in School File by Region, School Survey 2004–2005

Immunization Document	Weighted Colorado Estimate		Denver/Metro		East Central		Northeast		Southeast		Western Slope	
	n	%	n	%	n	%	n	%	n	%	n	%
Certificate of Immunization	32133	56.4%	207	54.8%	286	62.7%	172	35.5%	389	75.1%	326	72.4%
School Record	23960	42.1%	169	44.7%	237	52.0%	208	43.0%	151	29.2%	62	13.8%
Alternate Approved Certificate	4791	8.4%	30	7.9%	26	5.7%	5	1.0%	3	0.6%	132	29.3%
Physician Record	4199	7.4%	16	4.2%	42	9.2%	85	17.6%	28	5.4%	53	11.8%
Yellow Card	2077	3.6%	10	2.6%	0	0.0%	30	6.2%	16	3.1%	60	13.3%
Military Record	108	0.2%	0	0.0%	5	1.1%	0	0.0%	1	0.2%	0	0.0%
Other	2190	3.8%	22	5.8%	8	1.8%	1	0.2%	12	2.3%	3	0.7%

Figure 2. Of Children Up to Date at School Entry Percentage with Certificate of Immunization in File, by Region, School Survey 2004–2005



► Exemptions

During the school audit, exemption information was collected for each vaccine. The exemption field could be entered as medical, religious, personal, in process, none or left blank. Table 3 shows there were few children who exempted for medical or religious reasons for all of the required immunizations. Children who took a personal exemption for all of the required immunizations ranged from 1.0 percent in the Southeast region to 4.2 percent on the Western Slope. Children taking different exemptions for different vaccines, as shown in the mixed exemption category (i.e. a medical exemption for DTaP and a personal exemption for MMR) ranged from 1.9 percent in the Southeast region to 4.5 percent in the Northeast. The mixed other category included children with both none and unknown exemptions. The percentage who had none listed in the exemption field (category none) ranged from 8.0 percent on the Western Slope to almost 15 percent in the East Central region.

As they entered kindergarten the percentage of children who took a medical, religious, or personal exemption or were in process or had some combination of these was

- 6.3 percent for the weighted Colorado estimate,
- 5.9 percent Denver/Metro,
- 5.7 percent East Central,
- 8.2 percent Northeast,
- 3.5 percent Southeast,
- and 8.8 percent for the Western Slope.

To further explore immunization exemptions, the total number of exemptions taken for those children who were not up to date is shown in Figure 3. The majority of children who were not up to date had no exemption indicated in the school record (the none category).

Table 3. Percentage of Children Up to Date and with Exemptions, by Region, Colorado School Survey 2004–2005

Exemptions	Weighted Colorado Estimate		Denver Metro		East Central		Northeast		Southeast		Western Slope	
	n	%	n	%	n	%	n	%	n	%	n	%
Up to Date	43448	76.3%	286	75.7%	347	76.1%	365	75.4%	422	81.5%	356	79.1%
Medical	101	0.2%	1	0.3%	0	0.0%	1	0.2%	0	0.0%	0	0.0%
Religious	138	0.2%	1	0.3%	1	0.2%	1	0.2%	1	0.2%	1	0.2%
Personal	1339	2.4%	8	2.1%	9	2.0%	15	3.1%	5	1.0%	19	4.2%
In process	127	0.2%	0	0.0%	5	1.1%	1	0.2%	2	0.4%	0	0.0%
Mixed exemptions	1862	3.3%	12	3.2%	11	2.4%	22	4.5%	10	1.9%	20	4.4%
None	6636	11.7%	45	11.9%	68	14.9%	47	9.7%	48	9.3%	36	8.0%
Mixed other	2490	4.4%	18	4.8%	12	2.6%	26	5.4%	25	4.8%	16	3.6%
No records	803	1.4%	7	1.9%	3	0.7%	6	1.2%	5	1.0%	2	0.4%
Total	56944	100.0%	378	100.0%	456	100.0%	484	100.0%	518	100.0%	450	100.0%

Figure 3. For Children NOT Up to Date at School Entry Percentage with Exemptions by Region, School Survey 2004–2005

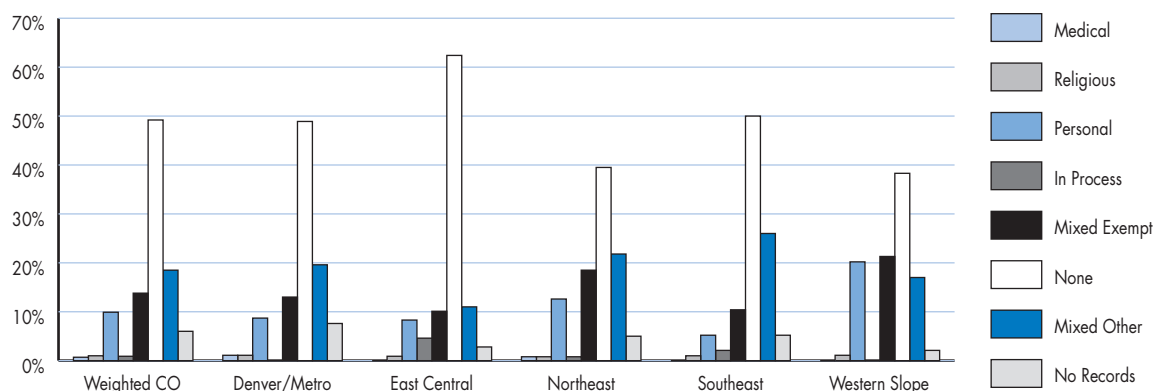


Table 4 lists the number and percentage of exemptions claimed by children who were NOT up to date by vaccine and by region. In general, most children who were NOT up to date had no exemption listed in their school record. For these children, there was no information in the school file as to why this child was NOT up to date for

the required school immunizations. The Northeast region was an exception to this where, except for MMR, most children who were NOT up to date took a personal exemption. In addition, for varicella, children who were NOT up to date either took a personal exemption or it was unknown (the exempt field was missing).

Table 4. Exemptions For NOT Up to Date by Vaccine, by Region, Colorado School Survey 2004–2005

	Weighted Colorado Estimate		Denver/ Metro		East Central		Northeast		Southeast		Western Slope	
	n	%	n	%	n	%	n	%	n	%	n	%
DTaP												
Medical	687	1.2%	1	1.7%	0	0.0%	1	2.1%	0	0.0%	0	0.0%
Religious	1018	1.8%	1	1.7%	1	1.9%	1	2.1%	1	2.3%	1	1.7%
Personal	14112	24.8%	9	15.0%	16	30.2%	26	54.2%	10	23.3%	23	39.7%
In Process	5782	10.2%	7	11.7%	5	9.4%	1	2.1%	3	7.0%	8	13.8%
None	29098	51.1%	34	56.7%	28	52.8%	13	27.1%	24	55.8%	24	41.4%
No records available	6246	11.0%	8	13.3%	3	5.7%	6	12.5%	5	11.6%	2	3.4%
Unknown	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Total	56944	100.0%	60	100.0%	53	100.0%	48	100.0%	43	100.0%	58	100.0%
MMR												
Medical	1268	2.2%	2	3.6%	0	0.0%	1	1.4%	0	0.0%	0	0.0%
Religious	933	1.6%	1	1.8%	1	1.4%	1	1.4%	1	1.7%	1	1.5%
Personal	12067	21.2%	9	16.1%	18	24.3%	25	34.7%	9	15.3%	22	33.3%
In Process	5206	9.1%	6	10.7%	6	8.1%	2	2.8%	2	3.4%	8	12.1%
None	29568	51.9%	29	51.8%	45	60.8%	29	40.3%	38	64.4%	30	45.5%
No records available	6024	10.6%	8	14.3%	3	4.1%	6	8.3%	5	8.5%	2	3.0%
Unknown	1879	3.3%	1	1.8%	1	1.4%	8	11.1%	4	6.8%	3	4.5%
Total	56944	100.0%	56	100.0%	74	100.0%	72	100.0%	59	100.0%	66	100.0%
Polio												
Medical	789	1.4%	1	2.0%	0	0.0%	1	2.0%	0	0.0%	0	0.0%
Religious	1311	2.3%	1	2.0%	2	3.8%	1	2.0%	1	2.5%	1	1.8%
Personal	15163	26.6%	9	18.0%	16	30.8%	28	54.9%	9	22.5%	22	39.3%
In Process	5874	10.3%	6	12.0%	5	9.6%	1	2.0%	2	5.0%	8	14.3%
None	26513	46.6%	25	50.0%	25	48.1%	14	27.5%	23	57.5%	23	41.1%
No records available	7114	12.5%	8	16.0%	3	5.8%	6	11.8%	5	12.5%	2	3.6%
Unknown	180	0.3%	0	0.0%	1	1.9%	0	0.0%	0	0.0%	0	0.0%
Total	56944	100.0%	50	100.0%	52	100.0%	51	100.0%	40	100.0%	56	100.0%
Hepatitis B												
Medical	1104	1.9%	1	2.9%	0	0.0%	1	2.0%	0	0.0%	0	0.0%
Religious	1589	2.8%	1	2.9%	1	2.6%	1	2.0%	1	3.4%	1	2.9%
Personal	17531	30.8%	9	26.5%	12	30.8%	19	38.8%	5	17.2%	19	54.3%
In Process	2794	4.9%	1	2.9%	5	12.8%	1	2.0%	2	6.9%	2	5.7%
None	17244	30.3%	11	32.4%	15	38.5%	11	22.4%	8	27.6%	5	14.3%
No records available	10045	17.6%	8	23.5%	3	7.7%	6	12.2%	5	17.2%	2	5.7%
Unknown	6638	11.7%	3	8.8%	3	7.7%	10	20.4%	8	27.6%	6	17.1%
Total	56944	100.0%	34	100.0%	39	100.0%	49	100.0%	29	100.0%	35	100.0%
Varicella												
Medical	139	0.2%	0	0.0%	0	0.0%	1	2.1%	0	0.0%	0	0.0%
Religious	1826	3.2%	1	3.3%	1	4.0%	1	2.1%	1	2.9%	1	2.6%
Personal	21137	37.1%	9	30.0%	9	36.0%	26	54.2%	11	32.4%	25	64.1%
In Process	2089	3.7%	0	0.0%	5	20.0%	0	0.0%	1	2.9%	1	2.6%
None	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
No records available	10302	18.1%	7	23.3%	3	12.0%	6	12.5%	5	14.7%	2	5.1%
Unknown	21452	37.7%	13	43.3%	7	28.0%	14	29.2%	16	47.1%	10	25.6%
Total	56944	100.0%	30	100.0%	25	100.0%	48	100.0%	34	100.0%	39	100.0%

► Reasons Why Kindergarteners Are Not Up to Date

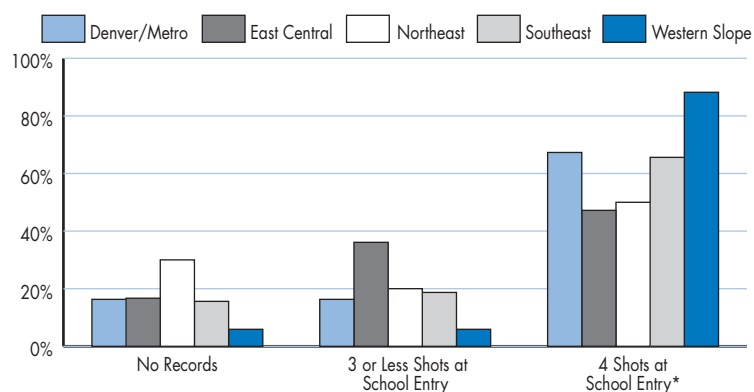
Excluding children who had taken an exemption, other reasons why children were NOT up to date were analyzed for each vaccine. The number and percentage of children not up to date and the reasons why are listed in Table 5. In addition, a graph and summary for DTaP, MMR and Polio are shown in Figures 4, 5, and 6.

Table 5. Excluding Children with Exemptions, Reasons Why the Child was Not Up to Date by Vaccine and Region, School Survey 2004–2005

	Denver/Metro		East Central		Northeast		Southeast		Western Slope	
	n	%	n	%	n	%	n	%	n	%
DTaP										
3 or Less Shots	8	16.3%	13	36.1%	4	20.0%	6	18.8%	11	25.6%
4 Shots at School Entry	33	67.3%	17	47.2%	10	50.0%	21	65.6%	30	69.8%
No records	8	16.3%	6	16.7%	6	30.0%	5	15.6%	2	4.7%
Total	49	100.0%	36	100.0%	20	100.0%	32	100.0%	43	100.0%
MMR										
1 st shot < 1 year old	7	15.9%	21	38.2%	26	57.8%	21	42.9%	11	25.6%
2 nd shot < minimum interval	2	4.5%	3	5.5%	0	0.0%	0	0.0%	0	0.0%
No 2 nd shot	27	61.4%	25	45.5%	13	28.9%	23	46.9%	30	69.8%
No records	8	18.2%	6	10.9%	6	13.3%	5	10.2%	2	4.7%
Total	44	100.0%	55	100.0%	45	100.0%	49	100.0%	43	100.0%
Polio										
2 or Less Shots	2	5.1%	6	17.6%	4	19.0%	3	10.0%	2	6.1%
3 Shots at School Entry	29	74.4%	22	64.7%	11	52.4%	22	73.3%	29	87.9%
No records	8	20.5%	6	17.6%	6	28.6%	5	16.7%	2	6.1%
Total	39	100.0%	34	100.0%	21	100.0%	30	100.0%	33	100.0%
Hepatitis B										
< 3 shots	15	65.2%	20	76.9%	22	78.6%	18	78.3%	13	86.7%
No records	8	34.8%	6	23.1%	6	21.4%	5	21.7%	2	13.3%
Total	23	100.0%	26	100.0%	28	100.0%	23	100.0%	15	100.0%
Varicella										
No Shot or History of Disease	13	65.0%	9	60.0%	14	70.0%	17	77.3%	11	84.6%
No Records	7	35.0%	6	40.0%	6	30.0%	5	22.7%	2	15.4%
Total	20	100.0%	15	100.0%	20	100.0%	22	100.0%	13	100.0%



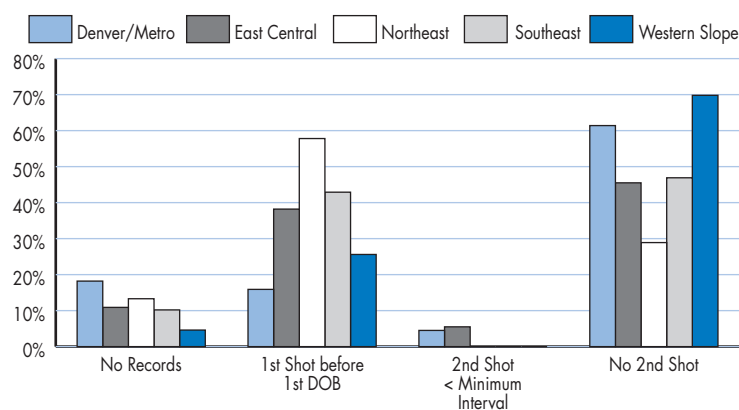
Figure 4. Reasons Why DTaP is Not Up to Date by Region, School Survey 2004–2005



The majority of children who were not up to date for DTaP had received only 4 shots at school entry and lacked the required 5th shot. If a child received the 4th shot after their 4th birthday, they were counted as up to date. Other reasons for not being up to date for DTaP were having 3 or less shots at school entry and no records in the school file.

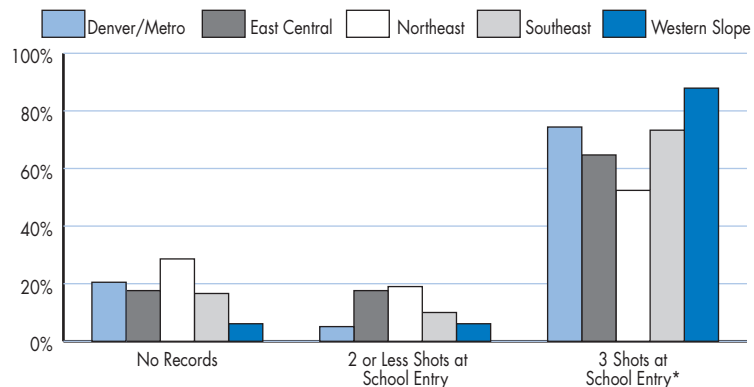
*If 4th shot received after the 4th birthday the child is counted as up to date

Figure 5. Reasons Why MMR is Not Up to Date by Region, School Survey 2004–2005



Children who were not up to date for MMR either received the 1st shot prior to their 1st birthday or had not received a second dose of MMR. A few children received the second MMR dose at less than the required minimum interval of 28 days and there were children with no immunization records in their file.

Figure 6. Reasons Why Polio is Not Up to Date by Region, School Survey 2004–2005



For polio, most children who were not up to date on this vaccine had not received the required 4th shot at school entry. Those children who received their 3rd polio shot after their 4th birthday were counted as up to date. Other reasons included two or less shots at school entry and no immunization records in the school file.

*If 3rd shot received after the 4th birthday the child is counted as up to date

► Factors Associated With Being Up to Date at School Entry

Other data collected during the school audit included the child's gender, race, ethnicity, and country of birth. In addition, the type of immunization staff at the school, and the amount of time the immunization staff was onsite was collected.

Table 6. Factors Associated with Being Up to Date at School Entry, School Survey 2004–2005*

	Denver Metro		East Central		Northeast		Southeast		Western Slope	
Gender	n	% UTD	n	% UTD	n	% UTD	n	% UTD	n	% UTD
Male	205	73.7	243	76.9	260	73.8	284	79.9	227	79.3
Female	161	79.5	208	75.5	224	77.2	227	82.8	214	80.4
Unknown	12		5				7		9	
Race										
American Indian	1	0.0	4	50.0	2	100.0	2	0.0	11	81.8
Asian	13	76.9	5	100.0	6	66.7	10	70.0	3	100.0
Black	12	83.3	35	68.6	5	60.0	4	100.0	1	100.0
Hispanic	63	74.6	60	71.7	66	68.2	63	88.9	86	80.2
White	151	80.1	314	77.1	380	76.8	415	80.2	309	81.2
Other	0	0.0	2	100.0	4	100.0	2	100.0	19	63.2
Unknown	138		36		21		22		21	
Ethnicity										
Hispanic	64	75.0	133	77.4	103	76.7	147	86.4	87	80.5
Not Hispanic	154	83.1	285	74.7	361	75.1	341	78.9	321	81.3
Unknown	160		38		20		30		42	
Immunization Staff										
Clerk/Secretary	40	82.5	201	76.6	38	76.3				
Clinic Aide	20	90.0								
Health Para/Aid	180	76.1	62	62.9	265	70.9	111	81.1	80	68.7
LPN	0	0.0					38	86.8	40	87.5
RN	138	71.0	193	79.8	181	81.8	361	81.2	330	80.6
Other	0	0.0					8	75.0		
Time on Site										
Daily	260	79.6	263	73.4	343	71.7	199	84.9	200	73.5
Weekly	118	66.9	193	79.8	141	84.4	252	77.3	247	83.8
Monthly							67	86.6	3	66.7
Country of Birth										
USA	188	78.7	361	76.2	431	77.5	416	82.0	236	82.2
Other	52	76.7	92	75.0	52	59.6	77	81.8	168	72.0
Missing	138		3		1		25		46	

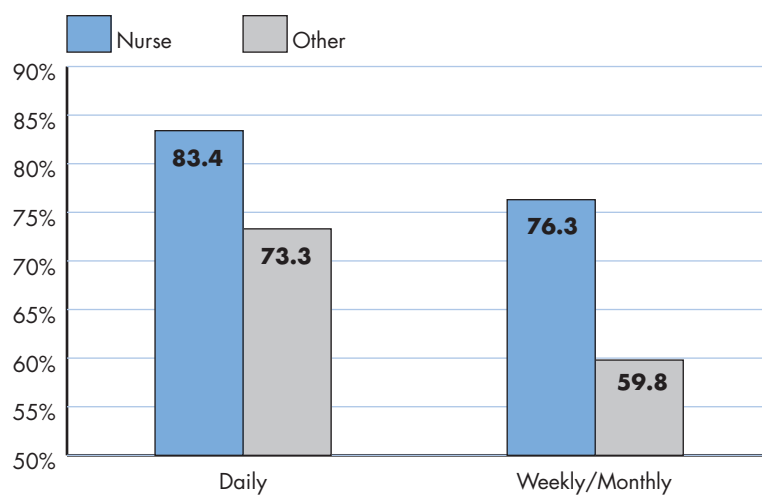
*Lightly shaded areas indicate statistical significance.

There was no association between a child's immunization status and his or her gender, race or ethnicity (Table 6). The significant associations that were found include

- A child born out of the country was less likely to be up to date on his or her immunizations compared to a child born in the USA. This finding was statistically significant in two regions, the Northeast and the Western Slope (Table 6).
- With the exception of the Denver metropolitan area, those schools that had a registered nurse or licensed practical nurse as the immunization staff person had higher rates of children who were up to date on their immunizations. This was statistically significant for the Northeast and Western Slope regions (Table 6).
- The amount of time a school staff member was assigned to immunizations was statistically associated with being up to date in the Denver metropolitan and northeast regions. The Denver metropolitan region had higher rates of up to date children when an immunization staff person was there daily while the northeast had higher up to date rates when an immunization staff person was on site weekly.

Figure 7 examines the relationship between immunization staff and time onsite. Having a nurse on site either daily or weekly is statistically associated with having more children up to date on the immunizations required for school entry.

Figure 7. Percent of Children Up to Date by Staff and Time on Site, School Survey 2004–2005



► Conclusions

These data from the 2004–2005 School Survey indicate that Colorado schools are not in compliance with the Colorado Board of Health Rules and Regulations. Only 76.3 percent of children entering kindergarten had received the required vaccines and only 56.4 percent of children had their records recorded on approved immunization certificates.

Although the percentage of children up to date at kindergarten school entry varied between the 5 regions, from 75.7 percent to 81.5 percent, these coverage rates were not statistically different. Colorado kindergarteners' low immunization coverage rate is occurring statewide and not associated with any given region.

For the children who were not up to date at school entry, most had no information in their record as to why they were not up to date. They were not in process nor had they taken an exemption. The assumption would be that the school believed these children to be up to date on their immunizations. In the event of a pertussis outbreak, susceptible children would not have been able to be correctly identified.

When the coverage rates of individual vaccines were analyzed, the most common reasons that children were not up to date were that the children were missing shots or they had no record of immunizations. It is likely that some percentage of the children who were not up to date had received the required vaccines, but did not have the documentation in their school files.

There were factors statistically associated with a child being up to date at school entry. Being born outside the USA was associated with not being up to date in the northeast region of Colorado and the Western Slope. Having a nurse onsite, whether daily, weekly or monthly, was associated with having more children up to date on immunizations required at school entry.

Supplemental funds to support this project were provided by the Centers for Disease Control and Prevention. Two counties used their own funds to over sample and, thus, have reliable estimates for their county. Many local health agency staff have expressed interest in over sampling to obtain county specific coverage rates. The Immunization Program is exploring avenues for funding for the increased number of audits associated with an over sample.

These data will be shared with state and local public health personnel, state and local school staff, and other interested individuals or organizations. The data will be used to increase the number of children who are up to date on their immunizations at school entry. A first step in this effort is the convening of a task force to develop methods for increasing the up to date immunization rate at school entry.

This method of collecting school immunization data will again be used during the 2005–2006 school year.



